



African Food Tradition rEvisited by Research

FP7 n°245025

Start date of project: **01/09/2010**

Duration: **51 months**

Deliverable number: D 5.4.1.2

Title of deliverable: Final report on sensory testing in Europe for Group 2

Deliverable type (Report, Prototype, Demonstration, Other): Report

Dissemination level (PU, PP, RE, CO)*: PU

Contractual date of delivery: October 2014

Actual date of delivery: January 2015

Work-package contributing to the deliverable: WP5

Organisation name of lead contractor for this deliverable: ESB/NRI

Authors for Kitoza Study: Ana Pintado, Maria João Monteiro, Geneviève Flidel, Danielle Rakota, Isabelle Maraval, Ana I. Costa, Regine Talon, Valérie Scislowski, Keith Tomlins, M. Manuela Pintado

This document has been sent to:

The coordinator by WP Leader	Date: January 2015
To the Commission by the Coordinator	Date: January 2015

* PU: Public; PP: Restricted to other programme participants (including the Commission Services); RE: Restricted to a group specified by the consortium (including the Commission Services); CO: Confidential, only for members of the consortium (including the Commission Services)

Table of Contents

Executive summary	2
General approach	3
Kitoza	4
Lanhouin.....	4
Kong.....	4
1. Sensory evaluation of Kitoza reengineered products in Europe	5
1.1. Kitoza summary	5
1.2. Introduction	6
1.3. Material and methods	7
1.3.1. Kitoza samples.....	7
1.3.2. Ethical assessment and consent	9
1.3.3. Sensory evaluation.....	10
1.3.4. Flash Profile.....	11
1.3.5. Statistical analysis.....	14
1.4 Results	14
1.5. Conclusion.....	15
1.6. Acknowledgement.....	16

Executive summary

In this deliverable the main results of sensory profile of reengineered products from group II in Europe are presented. In group 2 three main products were included in After project: Kong, Lanhouin and Kitoza. However, re-engineering for European market was closed for Kong and Kitoza, because as the main approach of sensory and consumer studies in Europe was to select the most promising products, it was decided to test only Kong and Kitoza since Lanhouin demonstrated the lowest interest in EU market.

In the case of Kong 4 samples were tested: The studied samples were Traditionally smoked Kong, Reengineered smoked and salted Kong, Reengineered smoked, salted and garlic flavoured Kong, Reengineered smoked Kong with liquid smoke. However, since the new products in Africa were considered closer in attributes to the usual traditional product, except for the characteristic flavours of added condiments (eg garlic), even for the samples using a high tech processing that was not available in Dakar, so the complete descriptive study of sensory profile was not performed. However, main sensory attributes differences were identified during the consumer study in 82 consumers and were presented in detail in D 5.5.2.2.

Final report on sensory testing in Europe for Group 2

So this deliverable on sensory profiling of reengineered product of group II in Europe only fully describe the sensory characteristics of reengineered Kitoza products.

The Kitoza samples for sensory tests included two different types of reengineering products: Kitoza beef (KB) and Kitoza pork (KP). Kitoza samples, beef and pork, were prepared in France by ADIV and INRA under collaboration with Madagascar and sensory tests were performed in ESB, Portugal).

For sensory profile all samples were rated by 18 sensory panelists using a Flash Profile (FP), a technique that combines individual panellist vocabulary generation through free choice profiling and attribute intensity ranking. The reference sample selected for comparison in the test sensory was a traditional Portuguese smoked loin sausage (PS).

A total of 23 sensory attributes were developed in FP sessions, with correspondent references/or anchors. The results showed different sensory profiles between the Kitoza samples evaluated. Differences between KB and KP were found for the aspect, KB was darker in the outside but had a raw aspect inside and had a more intense meat flavour, while KP showed to be more associated to odour descriptors such as smell of spices, smoked and sweet. The sensory profile of PS was characterized by a more intense and lasting after taste than any of the other meats and also showed a more cooked aspect.

The results herein gathered permitted to confirm a rich and discriminable sensory for each sample, and some identified attributes and intensities together with consumer study allowed the recommendation of some improvements in reengineered products to facilitate European market penetration in future.

General approach

The work encompassed in this deliverable had as main objective the evaluation of sensory properties of reengineered products improved to overcome food safety and product quality issues to facilitate their promotion and introduction to EU markets from group 2 – fermented salted meat and fishes consumed in Africa. In the case of sensory studies usually a trained panel is used to achieve a descriptive analysis of the sensory attributes of the products. In some cases where trained panel is not available with sufficient training, some techniques applied to consumers (ex. CATA) may gather a simpler description of sensory profile.

The products belonging to this group, focuses on one meat product (Kitoza) from Madagascar and two fish products (Kong & Lanhouin) in West Africa briefly described in following:

Final report on sensory testing in Europe for Group 2

Kitoza

Kitoza is a salted/dried meat (usually beef). Depending on the process conditions, the fermentation can be spontaneous. Sometimes, it is smoked in order to improve organoleptic and self-stability properties. It is a traditional product of Madagascar. A similar product is also produced and known as *Biltong* in Southern Africa.

Lanhouin

Lanhouin is a salted/dried fish (Cassava fish, *Pseudotolithus sp.*) spontaneously fermented. It is widely used as a condiment in Benin, Togo, and Ghana.

Kong

Kong (Catfish, *Arius heudelotii*) is traditionally smoked in Senegal for local and export markets. Such smoked fishes are not voluntarily fermented; however, a spontaneous fermentation step often takes place in the process of traditional dried fish.

In this research the purpose was to assess sensory profile of these reengineered products, and in Europe only reengineered Kitoza products was assessed. The reengineering of the products were achieved by ADIV and INRA in France together with Madagascar and sensory tests were performed in ESB, Portugal). In the case of Kong since the attributes gathered in consumer tests showed low discrimination from the traditional, fully descriptive profile was not obtained, since results were already described in traditional ones and reported in previous reports. The Lanhouin was only evaluated in Africa, since this product was the least adapted and promising in EU market, according to what was previously in executive summary. So the main sensory study conducted in Europe and described in this deliverable was Kitoza that was performed in ESB by a trained panel for Kitoza.

The sensory testing using trained panellists were used to provide important information regarding specific attributes of the developed products. This information was help to validate product development and the knowledge gained together with consumer preference was providing support to marketing and promotion studies to commercialise the new food products in the EU.

In order to efficiently describe the sensorial of these products in Europe the study will be presented in the following sections.

1. Sensory evaluation of Kitoza reengineered products in Europe

1.1. Kitoza summary

Kitoza is a traditional dish of Madagascar which is made from beef or pork meat. This food product is a salted/dried meat (usually beef). Sometimes, it is smoked in order to improve organoleptic and self-stability properties and depending on the process conditions, the fermentation can be spontaneous. It is usually eaten sliced (approximately 2–4 cm thick and 20 to 50 cm long strips).

The main objective of this research effort was to study the sensory profile of two smoked Kitoza meat samples, beef and pork that were improved through reengineering processes.

The Kitoza samples for sensorial were: Kitoza beef (KB) and Kitoza pork (KP). These samples were prepared according to an improved protocol followed by ADIV and INRA in France under collaboration with Madagascar and reported in WP3 -Process reengineering of meat and fish products. The reference sample selected for comparison in the sensory tests was a traditional Portuguese smoked loin sausage (PS).

For sensory profile all samples were rated by 18 sensory panelists using a Flash Profile (FP), a technique that combines individual panelist vocabulary generation through free choice profiling and attribute intensity ranking. The results were analysed using Generalized Procrustes Analysis (GPA), a multivariate statistical technique. XLSTAT (Addinsoft) software was used to analyze data.

The main results showed different sensory profiles between the Kitoza samples evaluated. KB and KP showed differences for the aspect, KB was darker in the outside but had a raw aspect inside and had a more intense meat flavour, while KP showed to be more associated to odour descriptors such as smell of spices, smoked and sweet. The sensory profile of PS was characterized by a more intense and lasting after taste than any of the other meats and also showed a more cooked aspect.

1.2. Introduction

Kitoza is a traditional dish of Madagascar which is made from beef or pork meat. Kitoza was consumed a long time ago by royalty and has since been popularized in this country over the years and actually is highly appreciated by Malagasy people of different social classes and even foreigners, is principally eaten with rice soups at breakfast or dinner.

Kitoza is generally prepared with beef, especially from the hump of Malagaszebus, but pork is also used. The pork-based Kitoza is usually found on the menu of *vary amin'anana* (rice broth and leafy vegetables) or *vary sosoa* (rice broth) in street eateries. In the traditional method of preparation, Kitoza is obtained after trimming and slicing beef or pork meat into approximately 2–4 cm thick and 20 to 50 cm long strips. Then the strips are uniformly salted. Depending on the preference, spices such as garlic, pepper and ginger may be added to enhance the taste and tenderize the meat. The meat strips are then threaded onto a cord and hung over a fire (fireplace or barbecue) in order to smoke the meat for at least 24 h. In butcheries, Kitoza is hung on a cord and then air dried at room temperature. In Imerina region, all air- or sun-dried meat is called Kitoza, even though the product is smoke-cured (called *saly* in the coastal regions of Madagascar) (Molet, 1982).

In Madagascar, meat is dried and/or smoked due to meat preservation conditions in hot countries, is a very difficult task due to the highly perishable nature of this foodstuff, and also to a lack of adequate cold storage infrastructure, and especially climate and environmental conditions that precipitate the rapid degradation of this product.

Meat preservation processes used in these countries, such as drying, salting, smoking, frying or fermentation, are inexpensive. Most meat-based products are obtained through a combination of these processes (Yacouba, 2010).

Currently, this dish still holds a place of choice on the household menu in Madagascar and with the evolution of food technology some producers now make smoked Kitoza.

Kitoza consumption has currently increased because of its ready availability in beef and pork butcheries, street eateries and supermarkets. Hygienic conditions during the preparation and preservation stages and the microbiological quality of the finished products are, however, not controlled. This product is widely consumed within the selected countries in Africa but do not meet EU food safety requirements. The reengineering of Kitoza aimed to overcome food safety and to improve nutritional properties of this traditional product issues to facilitate their promotion and introduction to EU markets. The reengineering processes were conducted in

Final report on sensory testing in Europe for Group 2

order to improve Kitoza for improving and adapt the local method to produce directly the Kitoza in Europe.

The main objective of this research effort was to study the sensory profile of two smoked Kitoza samples beef (KB) and Kitoza pork (KP) improved in this project.

1.3. Material and methods

1.3.1. Kitoza samples

Kitoza samples, beef and pork, were prepared in using French meat (due to restrictions to export meat from Madagascar). These samples were obtained through a reengineering process of the Kitoza products by ADIV and INRA in France under support of traditional knowledge of Madagascar; detailed description was reported in WP3 -Process reengineering of meat and fish products. These accomplished optimization study resulted in the final protocol (Figure 1). The process was controlled from the fermentation step, which was used in the bio-preservation strategy and added salt, spices and other condiments according to the traditional process. The step of drying and smoking were also optimized, as well as packaging, achieving a package that kept all the characteristics of the final product for the “Best before” data of 25 days at a controlled temperature.

AFTER (G.A n°245025) – Deliverable 5.4.1.2
Final report on sensory testing in Europe for Group 2

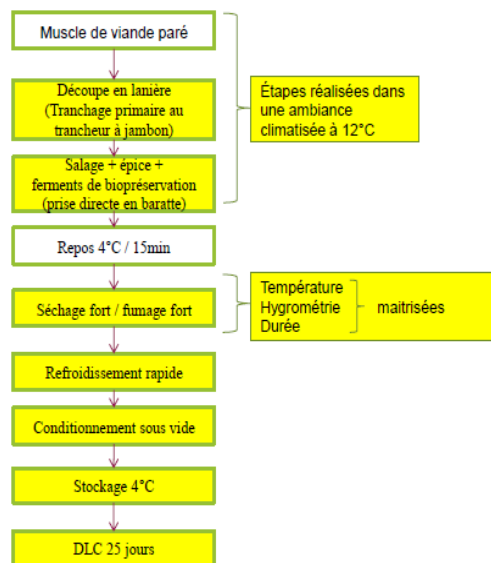


Figure 1 – Manufacturing diagram for the re-engineering process of Kitoza in Europe (ADIV, France).

The Kitoza meat samples were sent by ADIV refrigerated on vacuum packaging and stored at 4 ° C until consumer test. Two different types of Kitoza meat samples were produced for consumer's tests: Kitoza beef (KB) and Kitoza pork (KP) (both samples were used in sensory evaluation).

A traditional Portuguese smoked loin sausage (PS) was chosen as standard for comparison with the two samples of Kitoza in consumer tests. This smoked loin sausage is considered one of highest quality and acceptance by Portuguese consumer.

So, three different samples were presented to the consumers as following (Figure 2):

1. Kitoza beef (KB)
2. Kitoza pork (KP)
3. Traditional Portuguese smoked loin sausage (PS)

Safety of samples were guaranteed by application of GMP and GHP during production and confirmed by analysis by a certified French veterinary laboratory (cf D0.3.2).

Final report on sensory testing in Europe for Group 2

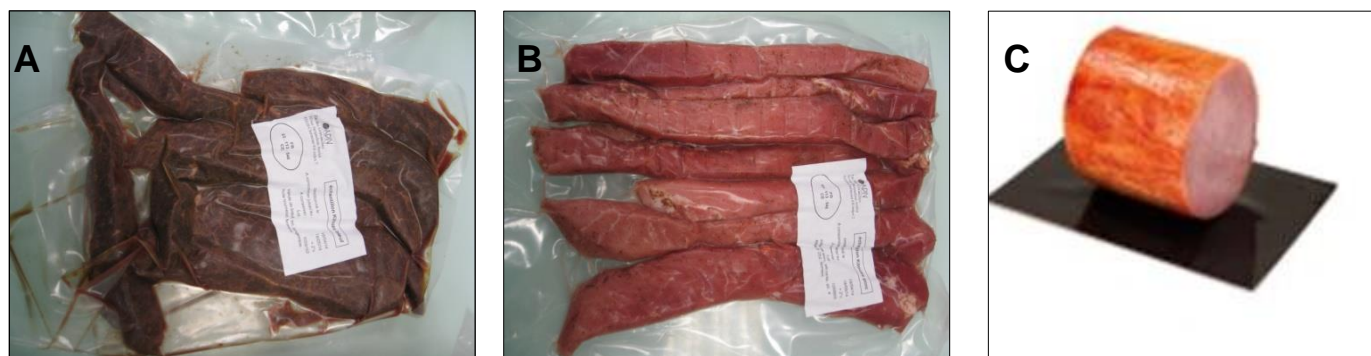


Figure 2 - Kitoza samples and traditional Portuguese smoked loin sausage. **A** - Kitoza beef (KB); **B** - Kitoza pork (KP); **C**- traditional Portuguese smoked loin sausage (PS) used for comparison.

The samples were presented to the consumers at room temperature, therefore were taken from the refrigerator in advance; they were served without any kind of cooking preparation. The samples were cut into thin slices of approximately 0.5 to 1 cm thick (see Figure 3 and 4).



Figure 3 - Preparation of Kitoza beef (slicing) for presentation to the consumers.



Figure 4 - Kitoza samples and traditional Portuguese smoked loin sausage for presentation to consumers.

1.3.2. Ethical assessment and consent

This study has been assessed and approved by the NRI Ethics Committee. Consent was signed by sensory panellists and consumers which participated in this study.

Final report on sensory testing in Europe for Group 2

Interviewers informed participants about the study and explained that their participation was entirely voluntary, that they could stop the interview at any point/time and that the responses would be anonymous.

1.3.3. Sensory evaluation

Kitoza products sensory profile was conducted at the Escola Superior de Biotecnologia – UCP, Porto in Portugal. For sensory profile all samples were rated by 18 sensory panelists (see Figure 5) using Flash Profile (FP), a technique that combines individual panelist vocabulary generation through free choice profiling and attribute intensity ranking. The panelists were recruited and selected in compliance with ISO Standard 8586:2012 (ISO, 2012a). The sensory panel was constituted by 18 selected assessors who completed a 3-month training period on sensory evaluation. This training focussed on language development, improvement of discriminating ability, memorization and rating intensities of selected attributes. Panel performance was evaluated in compliance with ISO 11132:2012 (ISO, 2012b).

Sessions were conducted at sensory room with controlled room/air temperature and lightning, these facilities comply with the requirements of ISO 8589 (ISO, 2007) and comprise a training room, dedicated kitchen and sensory booths with computerized data collection. The language used for the sensory testing was Portuguese.



Figure 5 - Panelists participating in the sensory test.

1.3.4. Flash Profile

FP was proposed in 2002 by Dairou and Sieffermann, is an alternative sensory analysis technique adapted from free-choice profiling to understand the sensory positioning of products, where untrained subjects select their own terms to describe and evaluate a set of products simultaneously.

The difference is that subjects rank the products on an ordinal scale for each term they individually created, instead of rating. They are asked to focus on the descriptive terms, not on the hedonic terms (Garruti et al., 2012).

The sensory evaluation included two sessions of FP. In the first session, the panellists receive the entire product set and are asked to individually generate sensory descriptors that differentiate among the products, and they are also instructed to avoid hedonic terms. At the session, the panellists are shown a pooled attribute list and are asked to update (add and/or subtract) their own individual lists if they wanted to (Lawless and Heymann, 2010). The records for attributes definition as represented in Table 1.

At the next session the panelists rank the whole product set for each of their individual attribute lists, see example and Table 2. In this technique if necessary, at subsequent sessions the ranking process is repeated.

A total of 23 sensory attributes were developed in FP sessions, with correspondent references/or anchors.

The individual sensory maps are treated with general procrustes analysis (GPA) a multivariate statistical technique to create a consensus and XLSTAT (Addinsoft) software was used to analyze data.

Final report on sensory testing in Europe for Group 2

Table 1 - Sheet used in the 1st session of the FP concerning to individually generate sensory descriptors for Kitoza samples and traditional Portuguese smoked loin sausage.

Sensory evaluation of of meat samples		
	Panelist name _____	Date _____
	Attribute	+Weak + Strong
External aspect	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
Internal aspect	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
Odour evaluation	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
Texture	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
Taste/Flavour	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
Others sensations	_____	_____
	_____	_____
	_____	_____

Final report on sensory testing in Europe for Group 2

Table 2 - Attributes list for meat samples used in the 1st FP session in order to guide the panelists to individually generate sensory descriptors for Kitoza samples and traditional Portuguese smoked loin sausage.

Flash Profile

It is intended that the **SELECT** descriptors that in your opinion **BEST** differentiate at least two of the samples.

You can use the descriptors of this list or other you want.

The selection and number of descriptors to be used depends solely on **YOUR PERSONAL OPINION**.

	Attributes	Scale
External aspect	Color tone aspect	Light Dark
	Spices aspect	Without Many
	Cor Rosa-Castanho	Pink / salmon Brown
Internal aspect	Thickness	Absent Thick
	Cooking aspect	Crude Baked
	Visible fat	Absent Much
	Color homogeneity	Heterogeneous Homogeneous
	Internal fissures	Absent Many
	Moisture	Dry Moist
Odour evaluation	Spices odour	Absent Strong
	Smoked odour	Absent Strong
	Fat	Absent Strong
	Sausage odour	Absent Strong
	Dried meet	Absent Strong
	Sweet odour	Absent Strong
Texture	Hardness	Soft/tender Hard
	Elasticity	Absent Very elastic
	Succulence	Dry Very juice
	Fibrous	Without fibers Many fibers
	cooking texture	Crude Well-done
	Soft	Rugged Very soft
	Astringent	Absent Strong
	Floury	Absent Strong
	Granularity	Without granules Many granules
Taste/Flavour	Spices flavor	Absent Strong
	Salty	Weak Strong
	Smoked flavor	Absent Strong
	Sweet flavor	Absent Strong
	Monoglutamate	Absent Strong
	Sweet	Weak Strong
	Meat flavour	Absent Strong
After Taste	After tast intensity	Weak Strong
	After tast duration	Short Long

1.3.5. Statistical analysis

XLSTAT software (Addinsoft SARL, France) was used to carry out the statistical analyses. The significance of statistical tests was evaluated at $p < 0.05$, unless otherwise mentioned.

The individual sensory maps are treated with general procrustes analysis (GPA) a multivariate statistical technique, a GPA reduces the scale usage effects by detecting and minimization individual differences (Næs et al., 2010) (Hernández-Carrión, Varela, Hernando, Fiszman, & Quiles).

1.4 Results

Sensory evaluation of Kitoza reengineering products in Europe

Flash Profile (FP) was performed in order to establish a sensory profile of Kitoza samples and Traditional Portuguese smoked loin sausage (PS) used for comparison.

A GPA was performed to evaluate the relationship between the sensory attributes of the Kitoza beef (KB), Kitoza pork (KP) and Traditional Portuguese smoked loin sausage (PS). The first two dimensions of the GPA analysis accounted for by 76,5 % and 23,4 % of the variance of the experimental data, respectively. As shown in Figure 6, can be highlighted that the first dimension was positively related to KB with thickness, meat flavour and colour tone aspect attributes and to KP with sweet odour, spices and smoked odour, KB had a more intense meat flavour. On the other hand, the second PC was related to after taste duration and intensity sensory attributes being associated with PS.

Differences between KB and KP were found for the aspect, KB was darker in the outside but had a raw aspect inside and had a more intense meat flavour, while KP showed to be more associated to odour descriptors such as smell of spices, smoked and sweet, The sensory profile of PS was characterized by a more intense and lasting after taste than any of the other meats and also shows a more cooked aspect.

Final report on sensory testing in Europe for Group 2

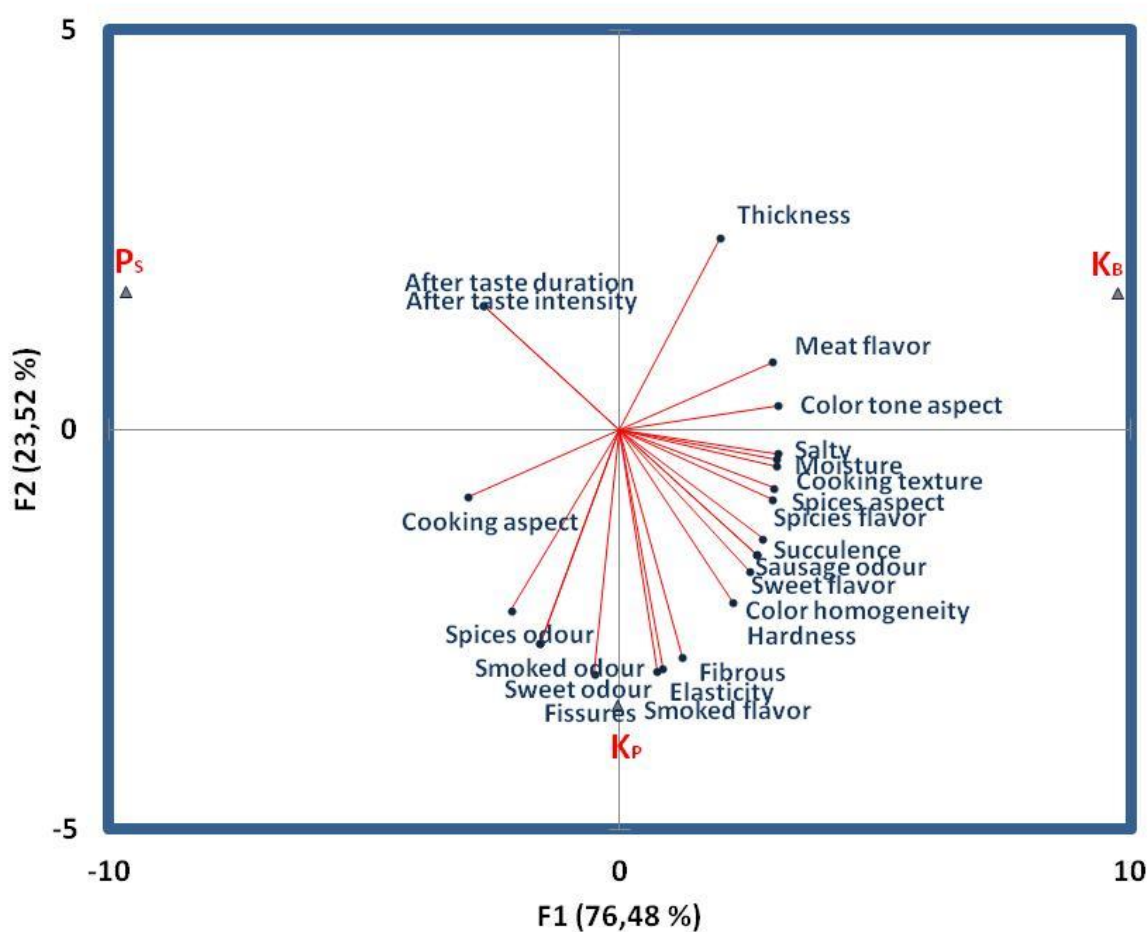


Figure 6 – GPA representation of FP data (representation of FP sensory attributes and Kitoza samples and Portuguese sausage). **Where:** KB- Kitoza beef; KP- Kitoza pork; Ps- traditional Portuguese smoked loin sausage

1.5. Conclusion

Sensory evaluation resulted in 23 attributes for the meat samples. Among the main results we can highlight that the sensory evaluation of meat samples revealed different sensory profiles. The major differences found were that KB was more related to thickness, meat flavour and colour tone aspect attributes and had a more intense meat flavour. KP showed more intense sweet odour, spices and smoked odour. On the other hand, PS was related to after taste duration and intensity sensory attributes.

Final report on sensory testing in Europe for Group 2

1.6. Acknowledgement

This publication is an output from a research project funded by the European Union (FP7 245–025) called African Food Revisited by Research (AFTER - <http://www.after-fp7.eu/>), with additional financial support and FCT (Fundação para a Ciência e a Tecnologia) – PEst OE/EQB/LA0016/2013. The views expressed are not necessarily those of the European Union.

1.7. References

- Dairou, V. and Sieffermann, J.M. 2002. A comparison of 14 jams characterized by conventional profile and a quick original method, the flash profile. *Journal of Food Science* 67: 826–834
- Garruti, D.S; Facundo, H.V.V.; Lima, J.R. and Aquino, A.C 2012. Sensory Evaluation in Fruit Product Development. In: *Advances in Fruit Processing Technologies*, ed. Rodrigues S. and Fernandes F.A.N, pp. 415–440. CCR Press Raylor & Francis. ISSN 1572-0330; ISBN 978-1-4398-5152-4 ISBN 978-1-4398-5153-1, DOI 10.1201/b12088-18
- Gower, J. C. (1975). Generalized procrustes analysis. *Psychometrika*, 40(1), 33-51. doi: 10.1007/BF02291478
- Hernández-Carrión, M., Varela, P., Hernando, I., Fiszman, S. M., & Quiles, A. Persimmon milkshakes with enhanced functionality: Understanding consumers' perception of the concept and sensory experience of a functional food. *LWT - Food Science and Technology (in press)*. doi: 10.1016/j.lwt.2014.10.063
- ISO (2007). ISO 8589 *Sensory analysis. General guidance for the design of test rooms*: International Organization for Standardization.
- ISO (2012a). ISO 8586 *Sensory analysis. General guidelines for the selection, training and monitoring of selected assessors and expert sensory assessors*: International Organization for Standardization.
- ISO (2012b). ISO 11132 *Sensory analysis. Methodology. Guidelines for monitoring the performance of a quantitative sensory panel*: International Organization for Standardization.
- Lawless, H.T. and Heymann, H. 2010. Flash Profiling. In: *Sensory Evaluation of Food*, ed. 2°, pp. 252–253. NY, USA: Springer. ISSN 1572-0330; ISBN 978-1-4419-6487-8 e-ISBN 978-1-4419-6488-5, DOI 10.1007/978-1-4419-6488-5.
- Molet L. 1982. Le feu domestique et la cuisine chez les merina (Madagascar), vol IX, p49-66
- Næs, T., Brockhoff, P. B., & Tomic, O. (2010). *Quality Control of Sensory Profile Data Statistics for Sensory and Consumer Science* (pp. 11-38): John Wiley & Sons, Ltd
- Yacouba I. 2010. Analyse des techniques traditionnelles de transformation de la viande en Kilichi dans la commune urbaine de Madaoua (rep. du Niger). 51p